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Case Report

Rupture of pseudoaneurysm of the superficial femoral artery over four years after self-expandable nitinol stent implantation

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ABSTRACT

Postcatheterization pseudoaneurysm is one of the most common vascular complications of peripheral angiographic procedures. An 83-year-old male received endovascular treatment (EVT) for a total occlusion lesion of left superficial femoral artery (SFA) due to intermittent claudication. After the subintimal angioplasty procedure with implantation of three self-expandable nitinol stents, angiography revealed contrast staining outside the stent margins. Duplex ultrasonography immediately after the procedure confirmed a pseudoaneurysm of 12 mm in diameter. There was no change in the size of pseudoaneurysm during the follow-up period. Four years after the initial procedure, he was admitted to our hospital because of swelling and pain in his left thigh. The angiography showed stent fracture at the proximal shaft of the stent. Furthermore, a fractured fragment of the stent was lying within the ruptured pseudoaneurysm, and active extravasation of contrast medium was identified. Surgical repair of the pseudoaneurysm was performed. We report a case of spontaneous pseudoaneurysm rupture of the SFA that had developed because of subintimal stent placement 4 years previously. If pseudoaneurysm is confirmed after EVT with subintimal stent placement, it should be treated by surgical or percutaneous methods, regardless of its size.

<**Learning objective:** In general, conservative observation is thought to be reasonable when the size of pseudoaneurysm is small (<20 mm) in the absence of severe pain. However, repair of pseudoaneurysm should be considered, when the pseudoaneurysm was caused by arterial wall rupture after subintimal stent placement for a totally occluded lesion of the superficial femoral artery. It has a higher risk of spontaneous rupture during the long-term period.>

Introduction

Postcatheterization pseudoaneurysm is one of the most common vascular complications of peripheral angiographic procedures. The incidence of pseudoaneurysm after diagnostic catheterization ranges from 0.05% to 2% [1]. When endovascular treatment (EVT) is performed, the incidence of pseudoaneurysms increases from 2% to 6%. Despite a low incidence, pseudoaneurysms commonly occur when more complex EVTs are performed, especially when potent antithrombotic and antiplatelet therapies are used. Pseudoaneurysms usually occur when an arterial puncture site does not adequately seal. In general, pseudoaneurysms are thought to be thrombosed spontaneously. A previous study reported that spontaneous thrombosis of pseudoaneurysm occurred in 88% of cases with small pseudoaneurysms at a mean of 23 days [2]. Another prospective study described that failure of thrombosis was associated with pseudoaneurysms >18 mm and the concomitant use of anticoagulation or antiplatelet agents [3]. Therefore, in the absence of severe pain, observation of small pseudoaneurysms (<20 mm) is thought to be reasonable. The most serious complication of pseudoaneurysm is rupture, although the exact rate and risk factors are not fully elucidated. Previous studies have indicated that the risk of spontaneous rupture of pseudoaneurysm is related to sizes >30 mm, presence of symptoms, large hematoma, or continued sac growth [2,4].

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We report a case of spontaneous rupture of a pseudoaneurysm of the superficial femoral artery (SFA) that had developed because of subintimal angioplasty with self-expandable nitinol stent placement 4 years previously.

Case report

An 87-year-old man was admitted to our hospital because of swelling and pain in his left thigh. The swelling developed acutely after walking, but he had no definite history of trauma. His past medical history included hypertension, dyslipidemia, and chronic atrial fibrillation. When he was 83-years-old, EVT was performed in the left SFA for intermittent claudication due to arteriosclerosis obliterans. Diagnostic arteriography revealed total occlusion of the left SFA. A 0.035-inch angled hydrophilic guidewire (Radifocus; Terumo, Tokyo, Japan) and a supporting 5-Fr multipurpose catheter (Multipurpose; Goodman, Nagoya, Japan) were used to create a subintimal dissection plane above the level of the occlusion. The wire then was exchanged into a 0.018-inch, stiff guidewire (Treasure; Asahi Intec, Aichi, Japan) and advanced through the subintimal plane until the occlusion was passed. After reentry into the true lumen at the distal end of the lesion, three self-expandable nitinol stents (Smart; Cordis, Miami, FL, USA; 6 mm × 100 mm, 7 mm × 100 mm, and 8 mm × 100 mm, respectively) were intentionally placed in the extraluminal space. Completion angiogram obtained after subintimal angioplasty with stent placement demonstrated good antegrade flow through the subintimal neolumen, but a contrast staining was observed outside the stent margins (Fig. 1). Duplex ultrasonography immediately after the procedure confirmed a pseudoaneurysm of 12 mm in diameter and 22 mm in length with small thrombi within the aneurysm (Fig. 1). During the follow-up period, duplex ultrasonographic examinations were repeated every 3 months, and confirmed that the pseudoaneurysm size had not increased.

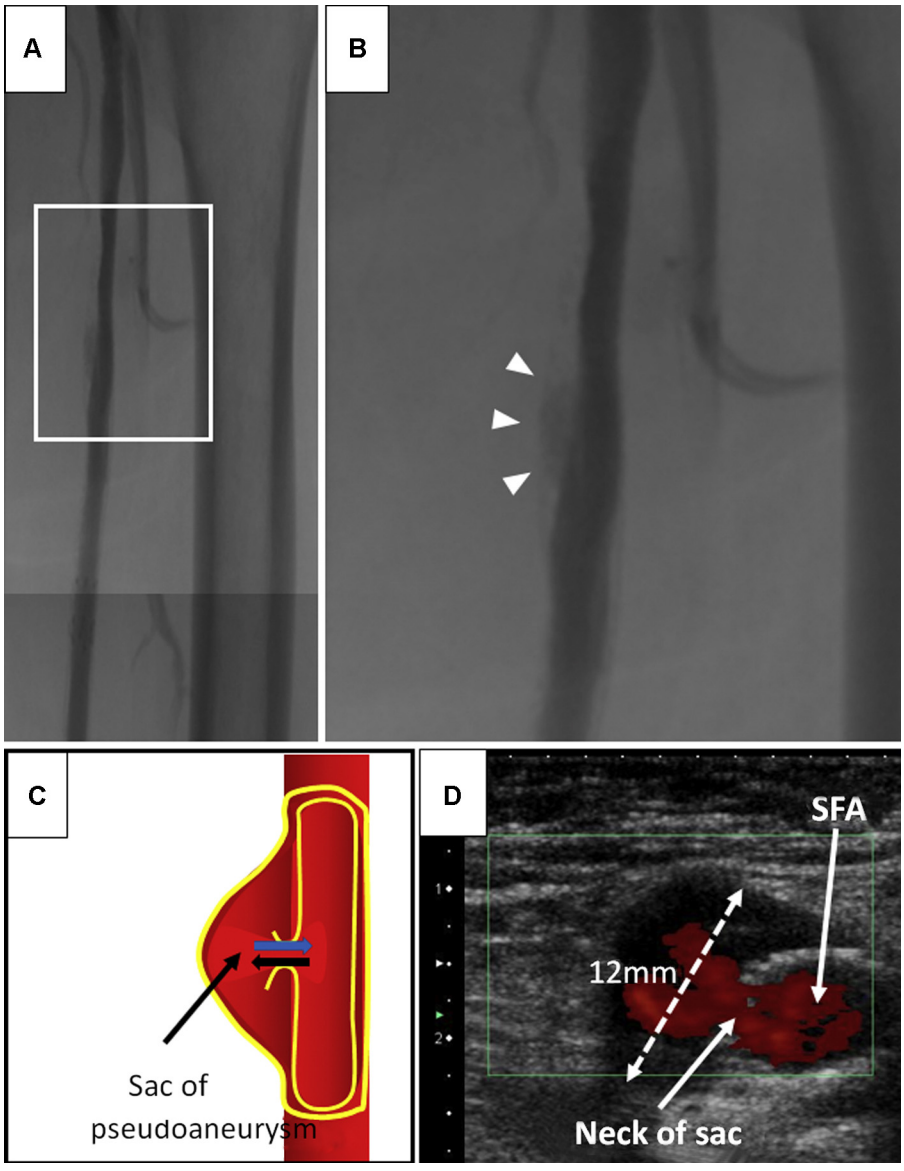

Fig. 1. Completion angiogram obtained immediately after subintimal angioplasty with stent placement. (A) The angiogram demonstrates good antegrade flow without residual stenosis in the left superficial femoral artery (SFA). (B) A magnified image confirmed the contrast staining outside the stent margins (arrowheads). (C) The schema of pseudoaneurysm. Pseudoaneurysm is usually defined as a communication between an extraluminary cavity and the SFA with a back-and-forth flow pattern with loss of vessel wall integrity (i.e. the appearance of damage to the adventitia or perivascular tissue). (D) An urgent duplex ultrasonography revealed an extraluminary cavity (largest diameter, 12 mm) and a back-and-forth flow between the cavity and SFA.

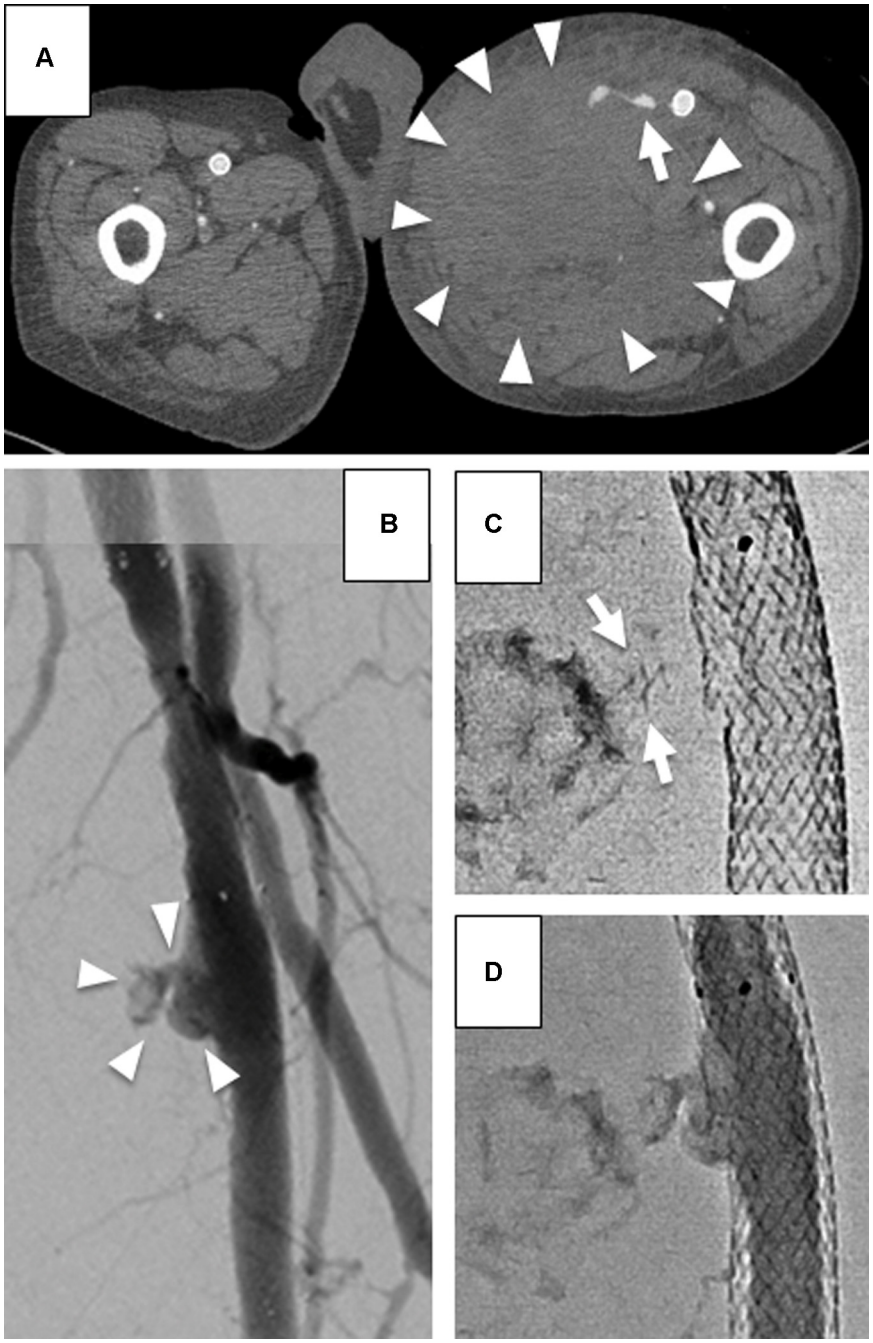

Fig. 2. The spontaneous rupture of pseudoaneurysm of the superficial femoral artery (SFA) 4 years after the initial procedure. (A) Contrast-enhanced computed tomographic image showing extravasation of the contrast medium (arrow) from the stented segment in the left SFA extending to the quadriceps femoris muscle (arrowheads). (B) A digital subtraction angiogram showing extravasation of the contrast medium at the proximal shaft of the stent without luminal narrowing (arrowheads). (C) A fractured fragment of the stent (arrows) lying within the ruptured pseudoaneurysm. (D) Active extravasation of contrast medium from the fractured stented segment.

He had been receiving anticoagulation therapy with warfarin and was taking aspirin and cilostazol daily since the stent placement. On arrival, the patient was hemodynamically stable, but the palpebral conjunctivas were slightly anemic. The distal pulses of his left lower limbs were palpable, and the rest of the examination was normal. Laboratory evaluation revealed that he was anemic with a hemoglobin concentration of 7.0 g/dL. Contrast-enhanced computed tomography revealed extravasation of contrast medium from the stented segment in the left SFA extending to the quadriceps femoris muscle (Fig. 2A). The preoperative diagnosis was pseudoaneurysm rupture, and diagnostic arteriography was performed. Angiography revealed stent fracture at the proximal shaft of the stent without luminal narrowing (Fig. 2B). Furthermore, a fractured fragment of the stent was lying within the ruptured pseudoaneurysm, and active extravasation of contrast medium from the fractured stented segment was identified (Fig. 2C and D). Surgical repair of the pseudoaneurysm was performed with fractured stent removal and arterial repair (Fig. 3). No complications were observed after the surgery, and he was discharged after the swelling and pain in his left thigh had resolved.

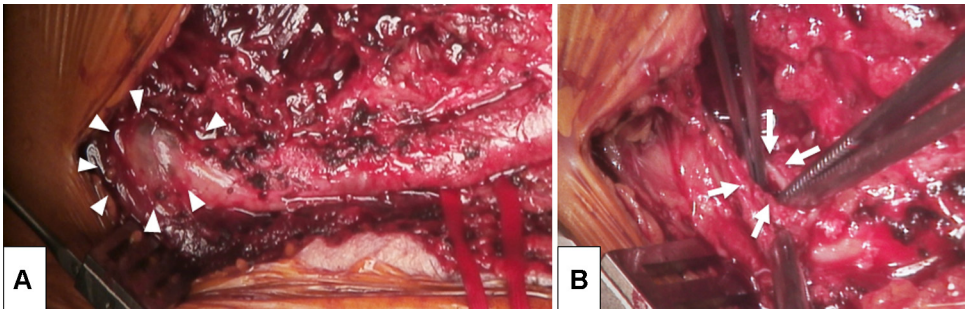

Fig. 3. Surgical repair of the pseudoaneurysm. (A) A 2-cm × 3-cm saccular pseudoaneurysm arising from the superficial femoral artery and adherent to the artery was noted (arrowheads). (B) After the surrounding clot was removed, longitudinal tear in the superficial femoral artery was identified (arrows).

Discussion

Our case report demonstrates that peri-stent strut contrast staining after subintimal stent placement in the SFA can lead to pseudoaneurysm formation and subsequent rupture due to stent fracture and its mechanical stress.

EVT has been recently accepted as a minimally invasive treatment for patients with peripheral artery disease. According to the TransAtlantic Inter-Society Consensus II, the applicability of EVT has been widened owing to the effectiveness and development of techniques and devices [5]. Although a previous study reported that the initial success rate of EVT for SFA lesions was 95% for stenotic lesions, it was only 85% for occluded lesions, mainly because the occlusion could not be passed using a guidewire [6]. The self-expandable nitinol stent has become widely available, and has shown promising improvements in short-term clinical outcomes after use for long diffuse SFA lesions. However, interventionists must first recanalize an occluded segment before considering stent placement. Subintimal angioplasty was recently introduced as an alternative to conventional intraluminal recanalization in the EVT of long-segment occlusions, particularly in the SFA [7]. The procedure is relatively simple and does not require extensive manipulations or operator experience. Therefore, this technique can increase the success of recanalization in long-segment occlusions and, often, procedural times reduce dramatically. However, the risk of arterial perforation may be higher in EVT with subintimal stent placement than that with intraintimal stent implantation because crural arteries are more fragile. Previous studies have reported the incidence of arterial perforation after subintimal stent placement following occluded lesions in the SFA to range from 2% to 3% [8,9]. In our case, the pseudoaneurysm developed probably due to arterial rupture caused by subintimal stent placement in the SFA. The other factor, which may be associated with pseudoaneurysm rupture, was stent fracture. Mechanical force exerted against the fragile outer wall of the pseudoaneurysm by the fractured stent induced the perforation. Early studies of nitinol stents in the femoropopliteal arterial segment reported an incidence of stent fracture of 32%. Patency at 12 months reduced from 84.3% to 41.1% in lesions with fractured stents [10]. Iida et al. [11] reported the factors associated with stent fracture were longer lesion length, larger number of stents used, and exercise. In our case, the patient underwent implantation with three stents, with a total length of 300 mm, and the patient's exercise adherence was high. In addition to these factors, the stent was placed in the segment without supporting tissue due to arterial perforation, and this may also have been a potential cause of stent fracture. Pseudoaneurysms usually occur when an arterial puncture site does not adequately seal. A previous study indicated that pseudoaneurysms thrombosed spontaneously in 88% of the cases when pseudoaneurysms were <30 mm [2]. Therefore, in general, observation of small pseudoaneurysms is thought to be reasonable in the absence of severe pain, such as this case. However, repair of pseudoaneurysms should be considered when the pseudoaneurysm is caused by arterial wall rupture after subintimal stent placement for a totally occluded lesion of the SFA. Although a minimally invasive surgical repair should be considered as the first choice in treatment for pseudoaneurysms, implantation of endovascular covered stents could also be another option to be considered. A previous study reported the feasibility and acceptability of endoluminal vascular repair with covered stents in selected patients [12]. On the other hand, the covered stent could provide disadvantages for younger patients with a long life expectancy, because the long-term consequences of implanting covered stents are unclear. Possibly, implantation of a covered stent limits the accessibility to the cardiovascular system for subsequent catheterizations in patients who are suffering coronary artery disease. In our opinion, the major contraindication for stent implantation is the presence of lesions near the femoral arterial bifurcation because of the concerning of the deep or superficial femoral arterial occlusion after stent placement. Another potential cause of spontaneous pseudoaneurysm rupture in this case may be the use of anticoagulation therapy in addition to dual antiplatelet therapy.

The clinical lesson from our case is that a pseudoaneurysm of the SFA should be treated by surgical or percutaneous methods, regardless of its size, when it occurs after subintimal stent placement.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgments

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